finding it in the alimentary canal only, but not in the blood and tissues, of persons affected with cholera, he is necessarily forced to assume that the alimentary canal is the exclusive organ into which the cholera poison enters and in which it has its breeding ground. On the other hand, Koch has ascertained that the "comma-shaped" bacillus is fatally affected by acid. This result, having been established by direct experiment, is naturally perfectly trustworthy, and is, besides, in complete harmony with what is known of other bacilli, both pathogenic and non-pathogenic, which, as is well established, succumb to the influence of acid.

Now, these three propositions, (1) that the "comma-shaped" bacillus is the cause of the cholera, (2) that the alimentary canal is the exclusive organ of entrance of the cholera virus, and (3) that the "comma-shaped" bacillus is neutralised and killed by acid, appear to me to be in hopeless contradiction.

The first two propositions are assumptions, the third is based on direct experiment, and is, as just stated, perfectly in harmony with other observations. If, then, this third proposition be true, the other two cannot be true, that is to say, if it is true—and there can be no doubt about it—that the "comma-shaped" bacillus succumbs to the action of acid, then it cannot be true that the "comma-shaped" bacillus is the cholera virus, nor that the alimentary canal is the sole entrance of the cholera virus. How, we may ask, can the "comma-shaped" bacillus pass unscathed the acid contents and the acid secretion of the stomach? To maintain, as Koch is reported to have done, that in all persons attacked by cholera the stomach must have been previously so deranged that its contents and secretions are not acid must appear to every one who has had any experience during a cholera epidemic an untenable proposition. On the one hand, it is known that such a serious disorder of the gastric mucous membrane as the total absence of acidity is of comparatively rare occurrence, while, on the other, in every cholera epidemic numbers of persons become affected with the disease in whom such a gastric condition, antecedent to the infection, can with certainty be excluded. E. K.

The Mountain System of the Malayan Peninsula

SOME new facts with regard to the mountain system of the Malayan peninsula may be of interest to many of your readers. In exploring through the native State of Perak I find that, in addition to the main range, which occupies about the centre of the territory and runs in a north and south direction, there are two other ranges belonging to quite different systems, and, as I think, of different geological age. The first is close to the coast. It is a series of ridges parallel to each other, but detached, having a north-north-east or south-south-west trend. These ridges are of granite, and rise to a considerable height, such as Gunong (Malay for mountain) Inas, over 5000 feet; Titi Wangsu, nearly 7000 feet; Gunong Hijau, 4400 feet, and Gunong Bubu, or Bubor, 5600 feet. The two latter I have ascended. Though they are detached from each other, they form a watershed between the coast and the inland drainage, and thus the River Perak has to drain an immense valley in a north and south direction until it finds an outlet to the south of the Dindings.

To the east of the Perak there is a small range about twenty-five miles long, perfectly detached from the other systems, and having generally a north and south direction, but sending off spurs a little west of south. This also is granite, but on its lower shoulders has thick deposits of stratified limestone, above and below which tin is worked. To the north this range is bounded by the valley of the River Plus, which here joins the Perak, and to the south by the mouth of the Kiuta. The latter river runs in a valley to the east of this range, and where it ceases joins the Perak. To the east of the Kiuta again comes the main range with many peaks over 7000 feet high; Gunong Riam probably reaching over 8000 feet.

The first series of ranges have their origin in the State of Keddah, just where the Malayan peninsula begins to widen out. This widening out is entirely due to this mountain system. The island of Penang is a part of it, and so are the islands called the Dinding Group. Were the coast to subside about 300 feet, we should have a narrow peninsula fronted by a series of large and very elevated granite islands having their longest diameter north-north-east and south-south-west. The second mountain chain has a different direction, and nowhere rises above 3000 feet; but both ranges are rich in tin. The first series has at its base Palæozoic schists, slates, and clays. The second has limestone. The Palæozoic rocks are rich in tin at the junction with the granite. The tin in the second range lies above and below the limestone, and has been derived from the older formation. The Palæozoic clays resemble very closely the gold-bearing slates and schists of Australia. To the south they are nearly denuded away, but in Lower Siam, from specimens I have seen, they are full of auriferous quartz reefs.

It is singular that in this mountain system we have the closest resemblance to the tin-bearing districts of north-eastern Australia. When exploring geologically the Wilde River district in 1881 and the Daintree River in 1879, I found that the sources of the tin were in detached granite mountains or groups of mountains—granite islands, so to speak, much higher than the present watershed of the country, but, being detached from each other, allowed the rivers to pass round and between them. I have referred to the same thing in Tasmania in my account of the physical geology of that country. Geologists in England can say if there is any resemblance to this state of things in the tin-bearing granites of Cornwall. I am inclined to think that we have in these rocks the remains of a former and very ancient mountain system.

I may add that it is a pity that we still find in recent books of high authority the statement reiterated that the highest mountain on the Malayan peninsula is Mount Ophir, near Malacca (4360 feet). Here are the heights of a few in Perak:—Slim Mountains, 6000 or 7000 feet; Titi Wangsu, 6900 feet; Riam, 8000 feet at least; Hijau, 4400 feet; Bubor, 5630 feet; Gunong Rampip, 7800 feet; Gunong Rajah, 6500 feet; besides many others in Reman and Pahang which have not been explored.

Arang Para, Perak, June 2 J. E. TENISON-WOODS

Chalk and the "Origin and Distribution of Deep-Sea Deposits"

IN consequence of Dr. Gwyn Jeffreys' letter, I feel it incumbent, in the interests of geology, to restate the position with regard to the question of the depth of the ocean in which the White Chalk of England was deposited. The cause that led to its deposition over a former land surface was indubitably a great though gradual depression of that area. The process commenced with the Neocomian age, when two seas encroached from north and south, until they were probably only separated by some relatively unimportant ridges or islands to the north of London. The depression seems to have been checked for a long period, but recommenced in the Gault age in a more serious manner. Now, according to Renard and Murray, the *Blue Mud*, with which I assume the Gault is to be identified, if with anything, is formed around shores and in partially inclosed seas, passing into a true deep-sea deposit at a distance from land. The limits of depth at which *Blue Mud* is formed are not stated, but the Mollusca of the Gault, if not indicating a very great depth, are quite against its being a very shallow-water formation. There are several deep-water genera, such as *Neœra*, *Leda*, *Limopsis*, *Cadulus*, *Dentalium*, *Eulima*, in it, and I believe that when the smaller Mollusca from it have been reinvestigated by the light of our present knowledge, a far greater similarity between them and deep-water forms will be apparent. The Gault also contains a very large number of Foraminifera and several Encrinites and other Echinoderms, which are not, I believe, characteristic of long-shore deposits; while there is a remarkable absence in it of the more distinctly shallow-water shells that abound in the Neocomian, and it has none of the coarser fragments of rock, 2 cm. in diameter, which are stated in Renard and Murray's paper to occur in the near-shore muds. We must assume a considerable depth of water for the Lower Gault—what depth I would be well pleased to leave to Dr. Gwyn Jeffreys to say. Now, if there is one fact more apparent than another, it is that the Upper Gault represents a deeper sea than the Lower, and therefore that the depression was maintained. The *Blue Mud* is replaced in neighbouring areas by *Green Muds and Sands* with Glauconitic grains which apparently are deposited in similar depths or situations; but the limit of depth at

which either the one or the other is dredged is not stated. A still continued depression takes us through *Green Mud* to the Chalk Marl, which apparently is a true Globigerina ooze[1]; and this passes into a true White Chalk. The White Chalk is the result of still farther depression, for it overlaps the other deposits, and as the great change in the character of the sediment cannot have been due to the shallowing of the sea, and yet must have had a cause, we must conclude it was due to deepening. Its enormous extent and thickness and great purity proclaim it in fact to be an oceanic deposit, and there does not appear to be anything with which it can be compared except Globigerina ooze.[2] The White Chalk of England could therefore only have been deposited under the conditions of depth, or remoteness from land under which the deposit of Globigerina ooze is possible. If Globigerina ooze is not a "terrigenous" deposit, Chalk is not, and it does seem singular that it should be classed as such by Renard and Murray, unless indeed they are prepared to point to an area in which a similar terrigenous formation is taking place at the present day. If genera now confined to shallow-water are present in it, it only proves that there must have been deep-water representatives of those genera in the Cretaceous ocean. This is in fact probable from at least two considerations, the one that the examination of the abyssal fauna is still relatively "extremely slight and cursory," as Dr. Gwyn Jeffreys has so amply admitted in the address he refers me to. It is probable that thousands of casts of the dredge have been made in the littoral zone for one in the abyssal zone, and we are, therefore, not in a position yet to say that any genus may not have representatives in the latter. The second consideration is far more important. Dr. Gwyn Jeffreys states that "all of them (the Cretaceous Mollusca) are evidently tropical forms." Now there is strong evidence from the present distribution, and the deposition of the Chalk, that the sea did not communicate with Arctic seas. Prof. Prestwich, in his anniversary address to the Geological Society, pointed this out in 1871. But even if it had, the Arctic climate during the Cretaceous period was a warm one, and for these two reasons, or either of them, the abyssal depths of the Chalk ocean were probably higher in temperature than they are now, while the temperature of the more littoral zones may have been almost tropical. Heat and cold seem greater factors in the distribution of Mollusca than depth of water. Relatively cold-loving genera or species of genera that could only have found the necessary temperatures then at great depths, may now find suitable habitats in shallow water. The "tropical Mollusca" of the Chalk might for this reason have been able to live at much greater depths when such were warmer, but are of necessity now restricted to those in which suitable temperatures are to be met with; and since these are now all relatively shallow, Dr. Gwyn Jeffreys may be quite right in saying that these extinct species have a shallow-water facies, without our being obliged to accept his inference that the Chalk sea was a shallow one. But if we accept the Mollusca pure and simple as a test of depth, their evidence as adduced is untrustworthy owing to the association together of those of the Gray Chalk and the Irish Chalk band of Kilcorrig. Eliminating these, we have no patelloid shell left but *Hipponyx*, and the Chalk species was completely different in habit to anything living. I do not know the Chalk *Chama* (if the Irish form, this is a limpet) or *Pinna*, and these must be very rare and even pos ibly drifted shells. The unextinct characteristic genera are in fact reduced to *Terebratula*, *Lima*, *Pecten*, *Armussium*, and *Spondylus*, and of these all but the latter are stated, in the address I am referred to, to have been met with in water 1450 fathoms deep.[3]

It would be impossible to dispose of a question of such importance in a mere letter. My object in writing is to elicit, if possible, the exact grounds on which Messrs. Murray and Renard base their statement that the Chalk was a shore deposit; and it would also be exceedingly useful if Dr. Woodward, Dr. Duncan, Mr. Davidson, and Mr. Carpenter would give their opinions, and the grounds on which they are based, on the probable depth required by each of the Cretaceous groups, respecting which they are the chief authorities. Dr. Gwyn Jeffreys is the only one who has contributed anything definite towards a solution of this most important geological problem, and for this, while believing other conclusions may be deduced than those he has arrived at, I and many other geologists heartily thank him.

J. STARKIE GARDNER

[1] Globigerina ooze is mainly composed, according to Murray, of 40 to 95 per cent. of carbonate of lime, oxides of iron and manganese, and argillaceous matter.

[2] Of reef-building corals there is not a trace either in it or in any contemporaneous formation, and nothing can be more opposed to all evidence than the supposition advocated, it will be remembered, by Wallace in "Island Life."

[3] There are few traces in the English Chalk of any Mollusca except those that possessed calcite shells, and what the rest were like as a group no one can say.

Animal Intelligence

THE following notes of facts observed in New Zealand may be thought of interest; in some way they may serve to illustrate Mr. Romanes' work on "Animal Intelligence": they are submitted without making an attempt to distinguish where they may overlap the fine line between instinct and intelligence. Cases which may show apparent intelligence or the reverse are recorded that we may arrive at a clearer view of the truth in animal life.

The dog cannot be passed over without mention; he is always to the fore where intelligence is required. Here, where sheep occupy so large a share in the employment of country people, the colly may be seen daily exhibiting its wonderful talents in controlling the movements of its simple charge. Its achievements are too numerous for recital.

Amongst birds we found the quail-hawk (*F. novæ-zelandiæ*), quickly learnt to avail itself of the property of the new settlers; it attacked both poultry and pigeons with the greatest determination directly these foreign birds appeared at the stations and outlying farms. The harrier (*Circus approximans*), more stealthy than the falcon in its depredations on the poultry, perhaps not less destructive, is careful if possible to convey its prey to a quiet spot free from interruption, where its meal can be finished at leisure in security. It found out the use of cornricks and haystacks as mouse-preserves; in some places several harriers might be seen at one time perched on the thatch carefully watching for vermin. It killed the rabbit; the swift-footed hare it found out could be hunted to best advantage in company: several of them would join in the pursuit, wheeling softly with every double of the distressed animal, till, quite exhausted, it lay stretched out in death. The harrier, the gull, the tern, all used to put in their appearance after the large grass fires of former days had swept miles of country; lizards, as they crept from under the stones laid bare by fire, seemed the attraction for all these birds. One autumn, when laid up with rheumatism, lights were brought into the room rather early. I often heard the sound of scratching on the window-glass, and found it proceeded from the efforts of an owl (*Athene, N.Z.*) to secure moths from the lighted-up window-panes; this was repeated for many evenings during parts of the months of April and May, so that I always expected my evening visitor. As a mouser this same species learnt the value of stations near barns and stacks; frequently, many scores of times, have I seen it keeping its solemn watch on a post or rail of the barnyard (see *Zoologist*, 1873, p. 3621). The kakapo or night-parrot (*Stringops*) shows intelligence in its nesting arrangements: the chamber at the end of a long tunnel is covered at the bottom with a great accumulation of excreta; each of these is an inch or more in diameter —the bird is a vegetable feeder—the warmth derived from this mass is secured by the young, reversing the proverb, "It is an ill bird that befouls its own nest."

The kea (*Nestor notabilis*) (see NATURE, vol. iv. p. 489). Its rapid development of a change of habit that led it to destroy sheep has proved very disastrous to many mountain sheep-farmers. It is remarkable that the discovery of the excellence of kidney fat should become known almost simultaneously through a long tract of country; how were beginners instructed to dig their beaks into the wool just above the sheep's kidneys? Horses have been wounded by them in the same part; all this shows a ready means of spreading information. One of the writer's sons snared a few fine specimens, but they very soon became aware of the snare and promptly avoided it. When thrown at, they learn to dodge the stone, just ducking or moving aside. One, imprisoned under an inverted bucket, after a time thrust its strong beak between the rim of the bucket and the floor, turned over the bucket and escaped.

The two cuckoos *Eudanymis* and *Chrysococcyx* offer a problem of peculiar interest as regards migration. The journeys they undertake and accomplish across wide expanses of ocean are amongst the most courageous and trying physical feats in bird history: "as bold as a hawk," "as brave as a gamecock," are proverbs that are befitting; but these birds deserve as much recognition for their adventurous daring.

When either of these species is observed flying, it will be